Differentiating the Left-handed Freshwater Snails of South-eastern Australia

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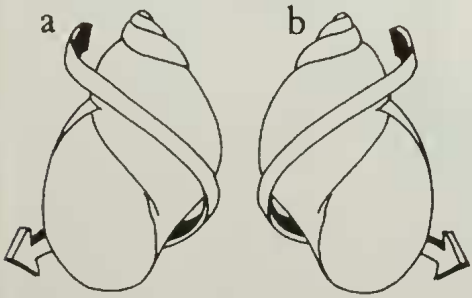
South-eastern Australia has a large and varied freshwater snail fauna (Smith and Kershaw, 1979) ranging from a wide series of small black operculates, family Hydrobiidae, to planispiral shells, family Planorbidae (part), dextral or right-handed high-spired shells, family Lymnaeidae and a series of sinistral or left-handed high-spired shells belonging to the families Planorbidae (part) and Physidae. In the helicoid, high-spired shells, the direction of coiling can be determined by holding the shell with the spire up and the aperture facing. Dextral or right-hand coiling shells have the aperture to the right of the median axis, sinistral or left-hand coiling shells have the aperture to the left of the median axis (Fig. 1).

The identification of freshwater snails has caused naturalist and field ecologists a great deal of trouble and confusion because the external appearance of the animal and shell can be so variable, even within a single species. Boray and McMichael (1961) showed that in lymnaeids environmental factors, such as variations in water quality, can affect changes in the phenotypic appearance of the shell. A particularly difficult problem is the differentiation of the various groups of sinistral or left-hand coiled, high-spired freshwater snails. The identification to species level of these forms will have to await a comprehensive revision of these large complex groups. However the object of this paper is to provide a differentiation guide to the four genera in two families that are likely to be encountered in south-eastern Australia. These are (Fig.2.):—

Family Planorbidae
- genus *Physastra*
- genus *Isidorella*
- genus *Glyptophysa*

Family Physidae
- genus *Physa*

Fig. 1. Direction of coiling (a) sinistral or left-hand coiling and (b) dextral or right-hand coiling.



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The characters used in the differentiation of these four genera are shell and external body characters, gross structure of the penial complex and gross form of the radula. The details of the various characters in these genera are given in Table 1.

SHELL. Tip of the spire can either be rounded or coming to a sharp point. In some the spire is high, whilst in others it can be very short to almost lost in the body whorl.

The columella may have a twist or be simple. This is an unreliable character and can be difficult to see in many specimens.

The shell may bear a series of periostracal hairs. These are usually arranged in rows around the body whorl. In some forms these can be so pronounced that the lines of hairs can be produced as carinations or ridges on the shell. In extreme forms, such as in *Glyptophysa*, the shell bears pronounc-

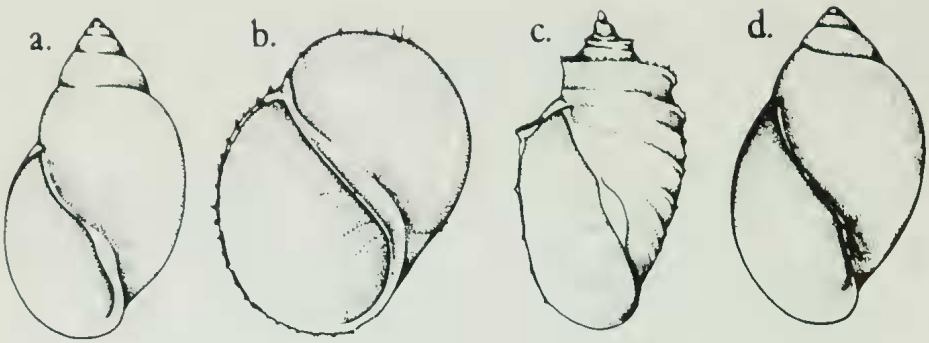

Fig. 2. Shells of (a) *Physastra*, (b) *Isidorella*, (c) *Glytophysa*, (d) *Physa*.

Table 1

Characters used in differentiation of sinistral freshwater snails.

Character	*Physastra*	*Isidorella*	*Glyptophysa*	*Physa*
Spire	rounded	rounded	sharply pointed	rounded
Columella twist	present	absent	present	present
Periostracal hairs	rare to absent	usually present	present	absent
Body colour	reddish	reddish	grey	pale
Pseudobranch	present	present	present	absent
Digital processes	absent	absent	absent	present
Flagellum on penis	present	absent	present	absent
Radula	entire	entire	entire	bifid

Fig. 3. Lateral view of *Physa* animal showing digital processes on the mantle.

ed carinations or ridges around the body whorl.

BODY. The general body colour can vary from red to heavily pigmented to very pale. The red colour denotes the presence of a pigment similar to haemoglobin.

The three planorbid genera posses a pseudobranch on the left hand side of the mantle cavity. This is not a very obvious character, particularly in a preserved specimen.

The genus *Physa* has a series of prominent digital processes on the mantle edge along the columellar margin (Fig. 3). These are particularly obvious in the crawling animal, but can be readily seen in the relaxed, preserved specimen.

PENIAL COMPLEX. The penis carries a flagellum in *Physastra* and *Glyptophysa*. This is a large blind-ending finger-like process arising from the inner end of the penial complex close to the point where the vas deferens enters the penis. The penial complex is situated immediately behind the left tentacle. It is easily dissected out from a relaxed preserved speciment using a stereo-binocular microscope (Fig. 4).

RADULA. The gross shape of the radula ribbon is different in the families Planorbidae and Physidae. In the Planorbidae the radula ribbon is entire, being a simple rectangle in shape. In the Physidae the radula is bifid in shape at the posterior end (Fig. 5).

The technique for extracting the radula is as follows:

1. Cut off the head-foot region or dissect out the buccal mass.
2. Boil in 10 per cent solution of caustic soda (sodium hydroxide) in a test tube until the tissues disintegrate on shaking.
3. Pour into small dish of water and search for radula (small transparent structure — shines under oblique light).
4. Transfer to water drop in microscope slide with mounted needle. Arrange, cover and observe on dark field.

The genera can be keyed out as follows:—

1. Digital processes on the mantle edge and bifid radula with oblique rows of teeth — Family Physidae, genus *Physa*.

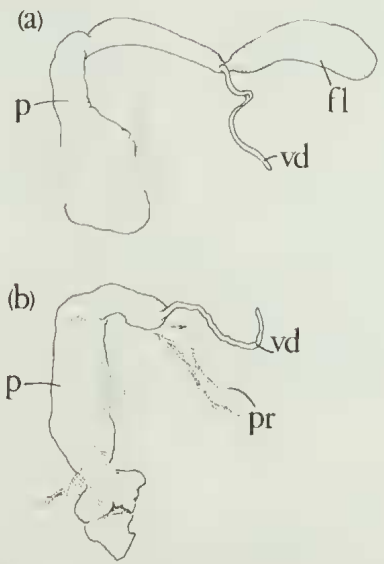

Fig. 4. Penial complex of (a) *Physastra* showing flagellum and (b) *Isidorella* without flagellum. (p — penis; pr — penial retractor; fl — flagellum; vd — vas deferens).

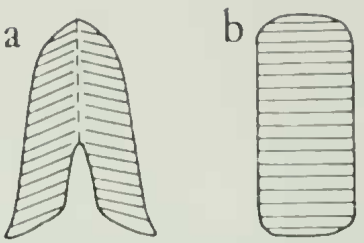

Fig. 5. Diagram showing (a) physid radula — bifid, (b) planorbid radula — entire.

1. Mantle edge entire, without digital processes; radula simple with transverse rows of teeth — Family Planorbidae. 2
2. Shell with sharply pointed spire, usually with pronounced carinations — genus *Glyptophysa*.
2. Shell with rounded spire, rarely with carinations. 3
3. Shell with columellar twist, periostracal hairs rare or usually absent, penis with pronounced flagellum — genus *Physastra*.
3. Shell without columellar twist, usually with periostracal hairs, penis without flagellum — genus *Isidorella*.

Work is currently in progress to amass collections and distributional data of these groups preparatory to undertaking taxonomic revisionary work on the group. The species currently recognised, with their habitat and distributional data for south-eastern Australia are listed below.

Many more species names exist in the literature for all these species. The ones currently in use represent a conservative assessment of the genera. Further species probably exist but much more reference material is needed before the extent of the fauna can be gauged.

Notes On Species

Physastra gibbosa (Gould, 1847)

Variable species, probably a complex of species, found throughout south-eastern Australia in freshwater rivers and lakes on weed and algae.

Isidorella newcombi (Adams and Angas, 1864)

A large, bulbous species found in the drier areas of northern Victoria and southern N.S.W. and South Australia in billabongs and creeks.

Isidorella hainesii (Tryon, 1866)

Usually a smaller species with a higher spire found in freshwater habitats that do not regularly dry out. Though previously thought to be found throughout south-eastern Australia, recent work has cast a doubt as to whether it occurs in Tasmania (J. Walker — pers. comm.).

Glyptophysa aliciae (Reeve, 1862)

Medium sized shell with strong spiral ridges in rivers and creeks of northern Victoria and southern N.S.W.

Glytophysa cosmeta (Iredale, 1943)

Small species with large aperture and body whorl and low spire, found in northern Victoria and southern N.S.W. This species was reported aestivating out of water as a method of surviving dry periods (Smith and Burn, 1976).

Physa acuta Draparnaud, 1805.

This is thought to be an introduced species, probably from Europe. Found in freshwater rivers and ponds in many parts of mainland south-eastern Australia. As research and collection assessment progress this appears to be a widespread and common species.

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